CLAIMS

1. A sintered plunger used for electromagnetic actuators, comprising:

an outer member composed of a soft magnetic material and having an inner hole formed therein; and

a shaft having an end portion which is fitted into the outer member,

wherein the shaft is composed of a ferromagnetic steel, the outer member is composed of a sintered member, and the shaft and the outer member are integrally bonded by sintering them.

2. A sintered plunger according to claim 1,

wherein the ferromagnetic steel has a magnetic flux density of 0.3 T or more in a magnetic field of 10 KA/m, and has a hardness of Hv 600 or more.

3. A sintered plunger according to claim 2, wherein the ferromagnetic steel is selected from a group consisting of a tool steel, a bearing steel, and a martensitic stainless steel.

4. A sintered plunger according to claim 3, wherein the tool steel is a high speed steel.

5. A sintered plunger according to claim 3, wherein the sintered plunger comprising:

a diffusion bonding layer which is formed between the shaft and the

outer member; and

a ferrite phase formed in the diffusion layer proximate to the shaft, and having width of 500 μm or less.

6. A sintered plunger according to claim 1, wherein the soft magnetic material is selected from a group consisting of a ferrite, an Fe-P-based alloy, an Fe-Si-based alloy, an Fe-Si-P-based alloy, a permalloy, a permemdur, and an electromagnetic stainless material.

7. A sintered plunger according to claim 6, wherein the soft magnetic material has a porosity of 15% or less.

8. A production method for a sintered plunger used for electromagnetic actuators,

the sintered plunger comprising:

an outer member composed of a soft magnetic material and having an inner hole formed therein; and

a shaft having an end portion fitted in the outer member,

the production method comprising:

preparing a raw powder having a soft magnetic property;

compacting the raw powder into a green compact having an inner hole;

fitting the shaft into the inner hole of the green compact, the shaft composed of a ferromagnetic steel;

integrally diffusion bonding the shaft and the green compact during

sintering at a temperature of from 1000 degrees C to 1300 degrees C, in a nonoxidizing atmosphere which is other than a carburizing atmosphere; and

quenching and tempering the shaft and the compact which are integrally bonded, so that the sintered plunger is obtained.

9. A production method for a sintered plunger according to claim 8, wherein fitting of the green compact and the shaft is clearance fit having a clearance therebetween of 50 μm or less which is fit size difference or is interference fit having an interference of 20 μm or less.